CRM D0010146.A2/Final
July 2004

Predictors of Attrition: Attitudes, Behaviors, and Educational Characteristics

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Approved for distribution: July 2004

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Executive summary

An applicant's education credential repeatedly has been shown to be a strong predictor of the likelihood of completing the first term of obligation. Because of the expense of replacing those who do not complete their obligations, the Services view attrition as an outcome of primary interest. In this research, we use information from a large, Service-wide survey of new recruits to explore how a number of noncognitive factors affect attrition. Our sample includes those who hold traditional high school diplomas, as well as those who hold a number of alternate credentials and those who join the Services with no credential ("dropouts").

We find ample evidence that noncognitive factors influence attrition rates. Moreover, in some cases, noncognitive factors have different effects on the attrition of high school diploma graduates and other recruits. For example, those who enlist at age 17 have higher attrition rates than those who enlist at age 18, regardless of education credential. While there is little difference in attrition rates between traditional diploma graduates who enlist at 18 and those who are older at enlistment, recruits with other credentials who enlist at age 20 or more have relatively low attrition rates.

Other noncognitive factors that influence attrition include smoking behavior before enlistment and attitude toward completing high school. All recruits who *considered* leaving high school attrite at higher rates than otherwise similar recruits, even in cases where the recruits did in fact complete high school. In other words, those who considered leaving school but actually stayed and earned degrees still have substantially higher attrition rates than other traditional diploma graduates.

In some cases, we are not certain how the noncognitive factors we measure are associated with attrition. For example, the relationship between smoking and attrition does not seem to be driven solely by

differences in physical fitness. Also, married women attrite at higher rates than single women, while married and single men attrite at approximately the same rates, suggesting that it is not marital status *per se* that affects attrition. In these cases, more research is necessary to pin down the causal pathway.

In addition to these individual characteristics, we explore some school characteristics not usually considered by recruiters. We find that those who have been expelled from a school attrite at higher rates (this is true for traditional diploma graduates, and those holding alternate credentials). Among those without high school diplomas, people who persisted in school into the twelfth grade before leaving have lower attrition rates than others. Finally, enlistees holding certificates of completion or attendance have markedly lower attrition rates than others without high school diplomas. In fact, attrition rates of those holding such certificates are roughly equivalent to those of high school diploma graduates. People most often hold such certificates because they completed all coursework but failed to pass a standardized test required by their home state for graduation. As states increasingly enact and enforce end-of-year and graduation tests, we expect that the number of certificate holders will increase; this group may be a good source of recruits.

In summary, our results suggest that noncognitive factors are important determinants of attrition, and that selecting recruits based on some noncognitive factors offers one possible way to reduce overall attrition.

Introduction

Potential military recruits are judged on the basis of both their education credential (such as a high school diploma) and their aptitude (measured by Armed Services Vocational Aptitude Battery, or ASVAB, scores). A recruit's education credential repeatedly has been shown to be a strong predictor of the likelihood of completing the first term of service [1, 2, 3, 4, 5]. In particular, recruits with traditional high school diplomas have markedly lower attrition rates than other recruits; see [6] for an early report of this finding.

Because of this strong relationship between education credential and attrition, DoD classifies credentials using a tier system. These tiers are based on past attrition rates. A high school diploma, along with one of several other recognized credentials, are referred to as Tier 1 credentials. GEDs and other alternate credentials are considered Tier 2. Finally, Tier 3 includes unrecognized credentials. Attrition rates of Tier 2 and 3 recruits are substantially higher than those of Tier 1 recruits. Current DoD accession standards require that at least 90 percent of accessions possess a Tier 1 credential; the individual Services often set even higher standards. In addition, recruits holding Tier 2 and 3 credentials must meet more stringent aptitude criteria than those holding Tier 1 credentials; specifically, Tier 2 and 3 recruits must attain a higher minimum score on the Armed Forces Qualification Test (AFQT) than those holding Tier 1 credentials.

Along with the most common credentials, a number of alternate credentials exist. Examples include an adult education diploma, no high school diploma but some college credits, a certificate of attendance or completion, and a homeschool diploma. A substantial proportion of current recruits already hold alternate credentials, and several changes are likely to increase the proportion of recruits holding such credentials in the near future. Although still small, the number of homeschooled students has increased dramatically over the last 20 years [7]. The number of people earning GEDs has also increased

dramatically, and the impacts of this change are likely to be much larger than the growth of homeschoolers; currently about 15 percent of students who receive high school credentials are GED recipients [8]. Finally, current education reforms in many states involve end-of-year tests for graduation; as of 2000, 44 percent of high school students needed to pass such tests to graduate [9, tables 39 and 154], and the trend is toward increasing such requirements. Table 1 shows a complete list of credentials and the tier to which each belongs.

Table 1. Tier placement of education credentials

Tier 1	Tier 2	Tier 3
High school diploma	GED	No credential
Adult education degree	Occupational program certificate	
1+ semesters of college (for non-diploma grads)	High school completion/ attendance	
.....	Correspondence school	
As part of 5-year pilot program: • Homeschooled • ChalleNGe		

Although the exact relationship between education credential and attrition is unclear, research suggests that the education credential measures something besides aptitude (e.g., "an index of social adjustment," "persistence," or "seat time"); despite relatively high test scores, those without high school diplomas are much less likely to complete a term of service than are those with diplomas [4, 10, 8]. However, possession of a credential is an imperfect measure of recruit quality; 25 percent of recruits entering the four Services with a high school diploma in 1999–2000 left before completing 36 months of their obligation.[1] (Attrition is a commonly used metric of success because of the substantial cost of replacing those recruits who do not complete their initial obligations.)

1. This figure, calculated using (unweighted) data from Survey of Recruits' Education and Background and DMDC records, is consistent with findings from other studies and periods; see, for example, [1], [3], or [11].

Because the vast majority of recruits are high school diploma graduates, most people who leave the Services before fulfilling their obligations are also high school diploma graduates. At the same time, a larger proportion of enlistees holding alternate credentials (i.e., GEDs) fail to complete their obligations. Therefore, information about the relationships between individual characteristics and attrition, both for graduates and for those with alternate credentials, is potentially quite valuable to the Services.

In this research, we focus on how various characteristics affect attrition. Some of these characteristics have been included in previous research on attrition, but others have not. Some involve behavior not directly related to education credential, such as smoking or marital status; we refer to these as "individual characteristics." Others involve the type or amount of education the enlistee attained or his/her attitude toward school; we refer to these as "educational characteristics." Examples include private school attendance as well as expulsion. In general, these variables do *not* measure aptitude; rather, they are related to the noncognitive factors that determine attrition (i.e., persistence or determination). We attempt to focus on the most policy-relevant of these factors. Finally, we include brief discussions of how state-level regulations can indirectly affect attrition rates.

Our first two reports [5 and 7] focused on how attrition rates vary by education credential. We used survey information to determine which recruits held alternate credentials; in regressions explaining attrition, we controlled for several personal characteristics not included in most data sets. These included smoking and drinking behavior before entering the Delayed Entry Program (DEP), attitudes toward responsibility and patriotism, and school activities (e.g., participation in school athletics). However, such measures have limited policy implications for two reasons. First, they are not included in most commonly available datasets. Second, even if these characteristics are found to explain attrition (as several were) and decision-makers decide to begin collecting such information, it may be difficult to collect accurate information on some of these characteristics and attitudes.

We believe that the information on the surveys is accurate because it was collected from recruits who had already entered the military and because the survey was given during bootcamp when honesty was stressed to new recruits. It may be more difficult, however, to collect such information on *potential* recruits, especially if they understand that their answers affect their probability of admission to the Armed Services or of securing desirable jobs. For example, it is likely that potential recruits will underreport alcohol use because most are under the legal drinking age. Also, potential recruits may overreport the importance of attitudes toward patriotism in hopes of gaining entry. For these reasons, we focus on attitudes and characteristics that we believe can be measured accurately. As before, attrition is our primary measure of success. In this report, we seek to explain how these individual and educational characteristics affect the variation in attrition rates among those with similar education credentials.

We find that some individual and educational characteristics are strong determinants of attrition behavior, even among recruits with similar education credentials. For example, marital status increases attrition rates but only for female recruits. Older recruits with alternate credentials have lower attrition rates than younger recruits with alternate credentials. In the case of traditional diploma graduates, however, there is little difference in attrition rates among those who are age 18 or more. Attending at least 12 years of school is also associated with lower attrition for those who lack traditional high school diplomas. Recruits with certificates of attendance or completion have substantially lower attrition rates than others holding alternate credentials; given current trends in education reform, the number of students who leave school with such certificates is likely to increase in the near future. Finally, state-level policies can affect attrition rates; homeschooled students from states with minimal regulation have higher attrition rates than homeschooled students from states with more stringent regulations.

Background

Data sources

Our data come from two sources. The information on specific education credentials, attitudes, and behaviors, is from a survey given to new recruits in each of the four Services between March 1999 and February 2000. As part of a congressionally mandated assessment of how enlistees with two alternate credentials compare with those who hold high school diplomas, CNA surveyed over 65,000 recruits. The Survey of Recruits' Education and Background allowed us to collect (a) information on exactly which recruits were homeschooled or had participated in the ChalleNGe program, and (b) additional background information not available in official records on all recruits. Along with detailed questions designed to determine which recruits held alternate credentials, the survey included information on recruits' backgrounds, school characteristics, and behaviors and attitudes. For more information about the survey, see [5, 7].

Next, using information collected on the survey (primarily social security numbers), the Defense Manpower Data Center (DMDC) matched the survey information to recruits' electronic personnel files. At the end of this process, we had files containing both information on what the recruits said about their educational credentials and what their official records reported. We also had other information from the survey not included in electronic personnel files, such as details on educational background and attitudes. Finally, the electronic personnel files include information about attrition.

Traditional high school diplomas and other credentials

In much of this research, we focus on two groups. We define high school diploma graduates (HSDGs) as those who hold traditional high school diplomas from either public or private high schools (we

explore differences between public and private school graduates below). The other recruits in our sample hold an alternate credential. Some of these credentials, such as adult education degrees, are considered equivalent to a traditional high school diploma for enlistment purposes; others, such as occupational certificates, are not. We consider these categories together; we also group dropouts with other alternate credential holders in our analysis.[2]

Our group of high school diploma graduates does *not* include those who were homeschooled; homeschooled recruits are a small group, and their attrition rates were explored in detail in two earlier reports [5, 7]. In a later section of this report, however, we do examine how state-level regulations affect the success of homeschoolers. We do not include ChalleNGe graduates in this group; like homeschoolers, they are a relatively small group, and their attrition rates are explored in two earlier reports [5, 7]. We do, however, explore the effect of participation in (as opposed to completion of) the ChalleNGe program in a later section of this report.[3]

Specifically, our group of alternate credential holders (NHSDGs) includes recruits with the following credentials:

- An adult education degree
- No high school diploma but one semester of college (either academic or vocational)
- Certification from an occupational program
- A correspondence school degree
- A certificate of attendance or completion
- A GED.

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2. We correct for specific credentials in our regression analysis; we do not assume that attrition rates are identical across alternate credentials.

3. Our analysis also omits those holding several other credentials. We exclude the relatively small group of recruits who enter with an advanced degree (from either a 2- or 4-year college). This group has historically low attrition rates. We also exclude those whose education credential could not be determined from their survey responses.

We also include those holding no credential ("dropouts") in our group of NHSDGs.

Attrition rates of HSDGs and NHSDGs differ sharply, as shown in table 2. However, individual characteristics differ markedly as well. For example, the percentages of NHSDGs who smoked before entering DEP or who report ever being expelled from a school are far higher than the percentages of HSDGs reporting the same behavior. In addition, NHSDGs have far lower measures of "determination," as measured by their attitudes toward schooling. Finally, NHSDGs tend to be older and are more likely to be married than HSDGs. A central goal of this research is to separate the effects of education credentials from those of individual behaviors, characteristics, and attitudes.

Table 2. Descriptive statistics of HSDGs and NHSDGs

Statistic	HSDGs	NHSDGs
12-month attrition rate	14.7	25.5
36-month attrition rate	25.5	41.1
Smoked prior to DEP	46.6	64.4
Ever expelled	3.2	11.5
Average age, at accession	19.3	20.2
Married, at accession	6.0	11.9
Percentage classified as "determined"[a]	91.3	63.0

a. We identify enlistees as "determined" if they did *not* consider leaving school for a specific list of reasons, including boredom, inability to adapt, and poor grades; refer to page 27 of Results section.

Individual characteristics

Our survey included a number of questions about recruits' individual characteristics. Some of these questions asked about specific attitudes and behaviors. For example, recruits were asked to indicate whether they had ever been suspended or expelled from school. The survey also included questions on each recruit's tobacco use before entering DEP as well as more commonly available information, such as age and

marital status. As table 2 shows, HSDGs and NHSDGs differ sharply on these measures.

We expect recruits who have been expelled to have higher attrition rates than other recruits; smoking could also increase attrition rates. It is not clear a priori how age should affect attrition. Perhaps the experiences of older HSDGs and older NHSDGs differ from those of younger enlistees; for example, job experience may decrease attrition among this group. Consistent with this, [12] finds that attrition rates decrease with age of entry for recruits with GEDs. Also, older NHSDGs may have more job experience than older HSDGs. (Reference [2] finds that early attrition increases with age but decreases with stable employment experiences.)

Previous research often found large differences in attrition rates by gender. Women usually attrite at higher rates than men, although the reasons for this are not completely clear [13, 14].

Like age and gender, marital status could affect attrition in various ways. The civilian literature suggests that marriage decreases labor force participation for women while increasing labor force participation and earnings for men [15, 16]. Therefore, we hypothesize that marital status may have different effects on male and female recruits.

Dropping out of school

High school students leave school for a number of reasons. Our survey asked all enlistees if they had ever *considered* leaving high school; if they answered in the affirmative, they were asked to choose all that applied from a list of potential reasons. About 14 percent of high school diploma graduates indicated that they had considered dropping out of school.

Most students who drop out of high school are capable of completing the academic requirements. The evidence is substantial that noncognitive factors are important in the decision to leave school. The work of [17, 18, and 19] suggests that many factors, such as family mobility, being held back in any grade, size of the school, socioeconomic status and family structure, parental involvement, achievement, and even

absences in elementary school, influence the decision to leave school. The work of [8] also suggests that noncognitive factors, particularly nonpersistence, are often drivers in the decision to drop out. The findings of [17 and 20] are also consistent with this notion.[4]

It is reasonable to hypothesize that noncognitive skills may be especially important predictors of success in the military because of the highly structured environment and the importance placed on teamwork and following orders. The work of [3] posits the importance of various noncognitive factors in both high school completion and military success. The work of [4] and [10] posits that a measure of "social adjustment" is related to both school completion and military success. Finally, the work of [20] suggests that nonconformity is related to dropping out; this could easily influence enlistees' success as well.

Reference [17] divides the dropout decision into cases of voluntary and involuntary withdrawal. Voluntary withdrawal is driven by student disengagement, while involuntary withdrawal occurs when grades, attendance, or misbehavior leads to expulsion or forced transfer. Obviously, the distinction between these behaviors is not absolute; for example, (voluntary) student disengagement may lead to poor attendance or poor grades, resulting in involuntary withdrawal. In either case, noncognitive factors are usually important. However, those students who become disengaged may have relatively high levels of cognitive ability and may therefore perform differently in the military than those students who have difficulty achieving passing grades. Also, some students may leave school for economic or family reasons; for example, they may be forced to find jobs or may become parents. These cases are not easily classified as either voluntary or involuntary withdrawal. Their military performance could well differ from that of enlistees who leave school for different reasons.

4. In related research, the findings of [21] and [22] suggest that such traits as perseverance and self-esteem have a strong (perhaps even dominant) effect on school grades and eventual earnings. Of course, attaining reliable, comparable measures of these traits is problematic. For this reason, most civilian labor market research has focused on the role of cognitive skills in determining educational and labor market outcomes.

Though we do not have information on mobility or family structure, we do know which enlistees considered dropping out and why. We use this information to form a measure of "determination" as suggested by [8]. We classify those who did *not* consider dropping out for social adjustment types of reasons as "determined"; we test the hypothesis that the reason for dropping out may influence eventual success in the military, and that those who are not determined by our measure but completed school may still have poorer military performance than those who never considered dropping out.

GED holders

Many who drop out of high school go on to earn GEDs (61 percent of all recruits with Tier 2 credentials hold GEDs).[5] The number and proportion of people earning GEDs has grown substantially in recent years [23]. Researchers disagree on whether attaining a GED actually *raises* a person's eventual earnings [24, 25]. However, across the population, GEDs and other dropouts differ. Reference [8] notes that GED recipients have higher AFQT scores than other high school dropouts; in fact, AFQT scores of GED holders are similar to those of high school diploma graduates who do not attend college. Consistent with this, GED recipients earn more than other high school dropouts. However, if we compare GED recipients and dropouts with similar AFQT scores, the *dropouts* actually earn more [26]. To quote one research team, "Inadvertently, the GED has become a test that separates bright but nonpersistent and undisciplined dropouts from other dropouts" [8, p. 141].

It is well established that recruits holding GEDs have much higher attrition rates than recruits holding regular high school diplomas; in fact, those holding GEDs have attrition rates on a par with dropouts [5, 11, 27]. This result has been found repeatedly over the last 30 years (since the inception of the All-Volunteer Force). Consistent with this, the civilian literature finds unfavorable outcomes for GED

5. This percentage was calculated from DMDC data using survey results to classify credentials, but the statement also holds when we use DMDC educational codes; see [5] for a discussion of the differences.

holders compared with dropouts after conditioning on ability. Because the Services generally limit entry of recruits holding Tier 2 and 3 credentials to those with AFQT scores of 50 or higher, cognitive skills are roughly equal between enlistees who hold GEDs and those who are dropouts.[6] Finally, [8 and 28] cite positive relationships between GED recipiency and illicit activities, as well as between AFQT scores and illicit activities for dropouts. For this reason, we examine the relationship between holding a waiver and holding a GED.

Certificate holders

Some students complete all required classes, yet fail to graduate either because they do not pass a required standardized test or because of excessive absences. These people are generally awarded a "certificate of attendance" or a "certificate of completion" rather than a high school diploma.[7] These credentials are considered Tier 2 for enlistment purposes. This group, however, differs from other NHSDGs in interesting ways. First, to the extent that "persistence" or "seat time" is important, this group resembles traditional HSDGs. Indeed, these certificate holders have lower attrition rates than many other NHSDGs. Our earlier reports found attrition rates for this group to be similar to those of HSDGs [5, 7].

At the time the Survey of Recruits' Education and Background was fielded, 16 states required that students pass a standardized test, as well as complete required classes, to graduate. These states tend to have relatively large populations; 44 percent of all high school students attended a school in a state with such a requirement in 2000 [9]. In addition, there is reason to believe that more states plan to enact such requirements in the future.

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6. In our data set, the average AFQT score of GED holders is 59.0, while that of dropouts is 56.9; the median scores differ by only 1 point.

7. In some cases, students may be awarded such a certificate if they lack credits; the way these certificates are awarded differs from state to state.

Years of education

Some evidence suggests that, among dropouts, those with more years of education have better outcomes [29]. For this reason, we test the effect of years of education on attrition rates among those who do not graduate from high school.

Public versus private high schools

In general, private school students have higher achievement than public school students. For example, private school students have higher test scores and attend college at a higher rate [30]. However, most private school students also come from more affluent backgrounds, so it is not clear that private school attendance *causes* higher outcomes. Considerable research has focused on this distinction; a typical finding is that Catholic school attendance raises outcomes for those students who live in areas with particularly weak public schools [31].[8] Our earlier reports [5, 7] indicated that homeschooled recruits are not "typical" homeschooled students; in the same way, recruits who attended private schools may not be typical private school students. For this reason, information about private school students as a group may be uninformative for DoD planners.

Homeschooled and ChalleNGe recruits, revisited

The first two reports using information from the Survey of Recruits' Background and Education focused on those recruits who were homeschooled and those who completed the ChalleNGe program. Results indicate that both groups had high attrition rates compared with traditional high school diploma graduates, although ChalleNGe recruits compared favorably with some other NHSDGs [5, 7]. In this report, we focus mainly on recruits holding other education credentials, but we include some additional analysis on homeschooled and ChalleNGe recruits.

8. Although many types of private schools exist, research often focuses on Catholic schools because about half of all private school students attend Catholic schools [9].

The ChalleNGe program

The National Guard Youth ChalleNGe program, first authorized in FY 1993, is operated jointly by the states and state National Guard units. The program targets "at risk" youth who are high school dropouts or expellees between the ages of 16 and 18 and are neither on parole nor on probation. The program's main goal is to provide enhanced employment potential and life skills training; it consists of a 22-week residential phase conducted in a quasi-military environment, followed by a longer mentoring phase. The program resembles bootcamp on several dimensions: ChalleNGe cadets form platoons, march, and engage in intensive physical training. However, the program also includes classroom instruction, some of which focuses on preparing participants to pass the GED exam.

To have their credentials considered Tier 1, ChalleNGe participants were required both to complete the ChalleNGe program and to pass the GED exam. Results of our previous reports [5, 7] indicate that ChalleNGe recruits have attrition rates substantially higher than those of traditional high school diploma graduates. Their attrition rates, however, compare favorably with other people holding GEDs.

Not all ChalleNGe participants graduate from the program; after the first 2 weeks, program leaders select those who may continue. In addition, some leave the program later, and some complete the program but do not pass the GED exam. Our questionnaire identifies not only ChalleNGe graduates but all enlistees who ever took part in the program. In this report, we examine those recruits who participated in a ChalleNGe program but who either did not graduate or did not achieve a GED. We compare the performance of those who take part in but do not graduate from the program with the performance of ChalleNGe graduates and other NHSDGs.

Homeschooling and state laws

The homeschooled population has increased rapidly over the last 20 to 30 years; growth was particularly pronounced during the 1990s [32]. Our survey of the literature, along with our own estimates of the number of homeschoolers, suggests that about 2 percent of all K–12 students in the United States are homeschooled today. Thus, there

were about 1 million homeschooled students in the United States in 2001, and perhaps 850,000 to 900,000 during the year of our recruit survey. The available research indicates that most homeschoolers score well above the average U.S. public school student on standardized tests [33, 34].

There is no single, accepted definition of homeschooling and no single governing body charged with ensuring that homeschools meet set standards. Homeschooling is legal in all 50 states, but the requirements concerning curriculum, notification of authorities, learning assessment, record keeping, and teacher qualifications vary considerably from state to state. Most states require that children receive a minimum number of days of instruction. Beyond this, some states have few or no requirements; in such states, parents are not even required to formally notify school authorities of their decision to homeschool their children. Other states require notification of authorities; others require notification and some level of testing or evaluation. Finally, the most stringent states require notification and testing/evaluation, and have additional requirements, most often about educational qualifications for parents who wish to homeschool. Table 3 provides a list of states falling in each category.[9] Because of the differences in regulations across states, the experiences of homeschooled students may vary considerably. For this reason, we test the hypothesis that state-level regulations affect the probability of success of homeschooled enlistees.

Table 3. Regulations governing homeschoolers, by state

No notice or other regulation	Parental notification only	Parental notification, test scores, and/or professional evaluation	Notification or test scores/evaluation, plus additional requirements
AK, ID, IL, IN, MI, MO, NJ, OK, TX	AL, AZ, CA, DC, DE, KS, KY, MS, MT, NE, NM, NV, WI, WY	AR, CO, CT, FL, GA, HI, IA, LA, MD, NC, NH, OH, OR, SC, SD, TN, VA	MA, ME, MN, ND, NY, PA, RI, UT, VT, WA, WV

9. Source of state-level data: Home School Legal Defense Association website, http:/www.hslda.org/laws/default.asp, accessed 7 January 2004.

Results

Our general approach is to begin by studying how attrition rates vary by attitudes, behaviors, and credentials. Our primary attrition measure is the 36-month attrition rate; this figure indicates the proportion of enlistees who fail to complete 36 months of their obligation.[10] After looking at these simple attrition rates, we use regression analysis to hold constant other factors that could also affect attrition. In the case of smoking behavior, we first report 36-month attrition rates for enlistees who reported smoking before DEP; we compare these rates with the rates of enlistees who report not smoking. While we suspect that smoking behavior may influence attrition rates, we know that smokers and nonsmokers have different education credentials and that education credential affects attrition. Therefore, some of the attrition differences we see when we divide recruits by smoking behavior are due to education credential.

We use regression analysis to separate out such differences as described above in order to observe the effect of smoking behavior, holding constant other factors. Our approach is to first run a single regression including both commonly used factors and factors specific to this research for HSDGs, and another for NHSDGs. We do this because we believe that such factors as age may affect attrition rates of these two groups differently. (To compare HSDGs directly with NHSDGs, we also run a single regression including both groups.)

10. We consider the length of a recruit's obligation when calculating attrition (e.g., a recruit who completed 24 months of a 24-month obligation is not considered to have attrited). We report unweighted attrition rates throughout this report; see [7] for indications that the difference in weighted and unweighted attrition rates is small as well as for details on weighting. We use t-tests to define the differences in attrition rates; t-tests provide the probability that the result occurred by chance. For example, if a t-test indicates significance at the 1-percent level, there is a 99-percent probability that the relationship did not occur by chance.

Recruit characteristics tend to occur together; as discussed, smokers are more likely than nonsmokers to be NHSDGs (refer to table 4). For this reason, it may be argued that DoD planners should care about simple attrition rates rather than regression-adjusted results. However, regression-adjusted results are important because they can separate out the effects of smoking from those of education credential; such results could suggest, for example, that recruiters should select nonsmoking enlistees (or perhaps that recruiters should urge potential enlistees to stop smoking before entering the Services) rather than suggest that recruiters should not recruit NHSDGs. In addition, as the proportion of young people who smoke changes, regression-adjusted results will allow DoD planners to have some idea of how this is likely to affect recruiting and retention.

Individual characteristics

Smoking

The Survey of Recruits' Education and Background included questions about alcohol and tobacco use in the time before the recruits entered DEP. As discussed, we do not examine the questions on alcohol use because we suspect it will be difficult to collect accurate information on alcohol use from potential recruits. However, we note that there is a fairly high correlation between tobacco and alcohol use.[11] Table 4 provides some descriptive statistics on those recruits who used tobacco before entering DEP; smokers are more likely than nonsmokers to be (non-Hispanic) white and male. Smokers, especially "heavy" smokers, are more likely to be NHSDGs. Heavy smokers have higher AFQT scores than nonsmokers, probably because many are NHSDGs and thus often face higher AFQT requirements.

To provide some context for the smoking behavior of recruits, we compare these numbers with two other sources. While half of our sample reported some tobacco use before entering DEP, 35 percent of all U.S. high school students report using tobacco in the year 2000

11. For example, the correlation between "heavy" smoking and "heavy" drinking is 0.17; this correlation is significant at the 0.01-percent level.

[35]. In a 2002 DoD-wide survey, 34 percent of Servicemembers reported using cigarettes in the prior 30 days [36]. Therefore, it appears that before entering DEP, recruits smoked at high rates compared with all high school students and with Servicemembers at large.

Table 4. Characteristics of smokers and nonsmokers

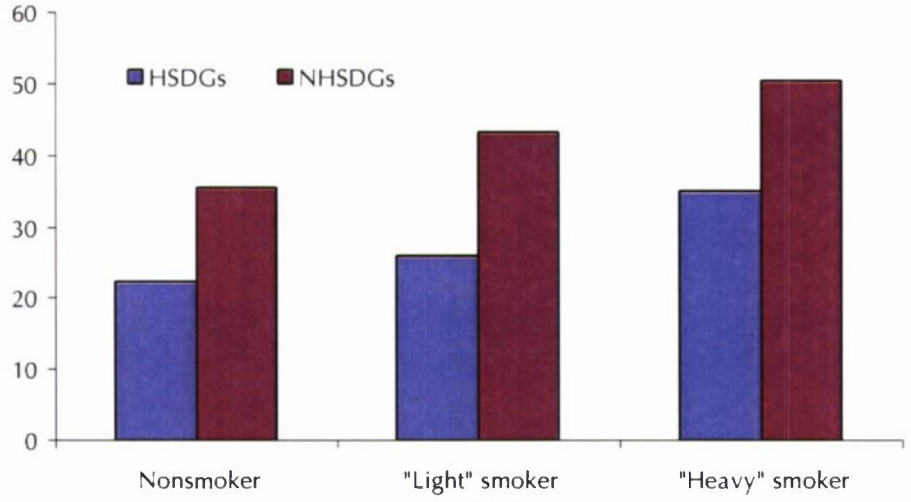
Characteristic	Non-smokers	"Light" smokers—used tobacco less than 4 times/week	"Heavy" smokers—used tobacco at least 4 times/week
Percentage male	79.7	85.5	84.5
Average age	19.4	19.4	19.6
Percentage white	61.2	69.5	81.6
Average AFQT score	58.2	58.2	59.5
Percentage NHSDGs	12.6	16.1	27.0
36-month attrition rate	22.2	26.4	39.4

Next, we examine the effect of smoking behavior on attrition. As shown in figure 1, smokers have higher attrition rates than nonsmokers. Regression results indicate that, for both HSDGs and NHSDGs, smoking before entering DEP is associated with increased attrition even after we correct for other characteristics. For HSDGs, light smoking is predicted to increase attrition by 4 percentage points; heavy smoking is predicted to increase attrition by 13 percentage points (compared with nonsmokers).

For NHSDGs, the results are similar. Light smokers are predicted to have attrition rates that are 8 percentage points higher than nonsmokers, and heavy smokers are predicted to have attrition rates that are 15 percentage points higher than nonsmokers.

This effect is quite large. For HSDGs, smoking increases attrition twice as much as having been expelled from school and, across the whole sample, the effect of smoking on attrition is often larger than the effect of education. For example, the predicted probability of attrition of a heavy smoker who graduated from a public high school is very close to that of an otherwise similar nonsmoking dropout or GED holder. (Results for the whole sample are given in table 22 of the appendix.)

Figure 1. Predicted attrition rates, by smoking behavior and education credential[a]



a. Coefficients significant at the 1-percent level or better.
"Light" smoker—used tobacco less than 4 times per week prior to entering DEP.
"Heavy" smoker—used tobacco at least 4 times per week prior to entering DEP.

We do *not* have information about smoking behavior after these recruits joined the Services. Recruits are urged to stop smoking before entering the Services; there is little or no opportunity to smoke during bootcamp. It is likely that many recruits who smoked before DEP begin to smoke again after bootcamp, but it is also possible that other, nonsmoking recruits begin smoking during their obligation. These results do not define the precise pathway(s) through which smoking increases attrition.

If the effects associated with smoking increase attrition because smokers are less physically fit, we might expect the effects to occur early. If other noncognitive factors associated with smoking increase attrition, however, we might expect smokers to attrite at steadily higher rates throughout the first term. Based on this thinking, we attempted to determine when the effects of smoking occur.

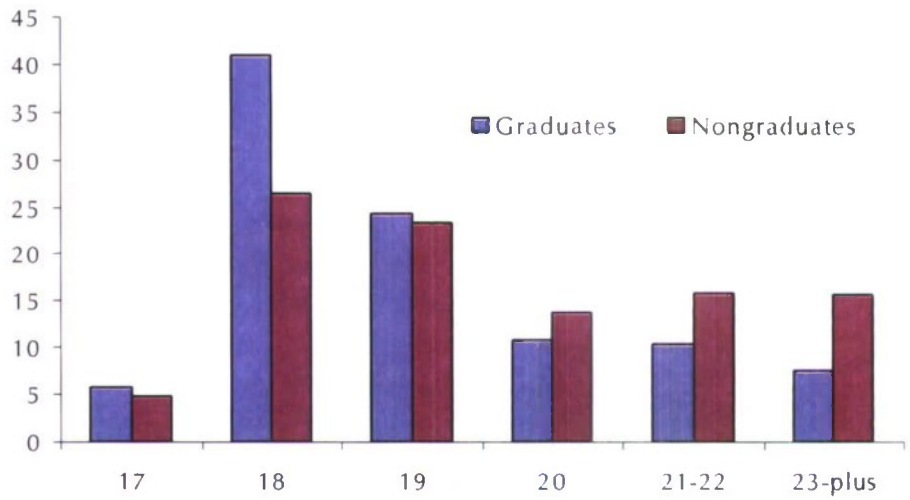
We found that the sample of heavy smokers had 3-month attrition rates about 3 percentage points higher than nonsmokers, consistent with differences in physical fitness. However, conditional on surviving

the first 3 months, heavy smokers had 12-month attrition rates that were 4 percentage points higher than nonsmokers' rates. Conditional on surviving the first 12 months, heavy smokers had 36-month attrition rates that were 8 percentage points higher than nonsmokers' rates. Thus, smokers' high attrition is not solely due to bootcamp attrition. Attrition rates do not converge between heavy smokers and nonsmokers; in fact, they diverge over time. Therefore, it is likely that some noncognitive factor or factors associated with smoking increase post-bootcamp attrition.[12]

Age

There is considerable variation in the age of new enlistees. As shown in figure 2, the most common age of both HSDG and NHSDG enlistees is 18 (the median age is 19 in each case). However, NHSDGs are more likely than HSDGs to be 20 or over. This suggests that NHSDGs may have more work experience than HSDGs.

Figure 2. Age distribution of enlistees



12. We also found that the attrition differences between heavy smokers and nonsmokers are not constant across the Services. Specifically, the 3-month differences are largest for Marine and Navy recruits. This may reflect some bootcamp differences between the Services.

When we look at attrition rates by age, we see that, for HSDGs, attrition rates are lowest for those who enlist at age 18; both younger and older recruits have higher attrition rates than 18-year-olds (see table 5). NHSDGs under 18 also have high attrition rates relative to 18-year-olds, but attrition does not increase as sharply with age for this group; in fact, NHSDGs age 21 or 22 have lower attrition rates than other NHSDGs.

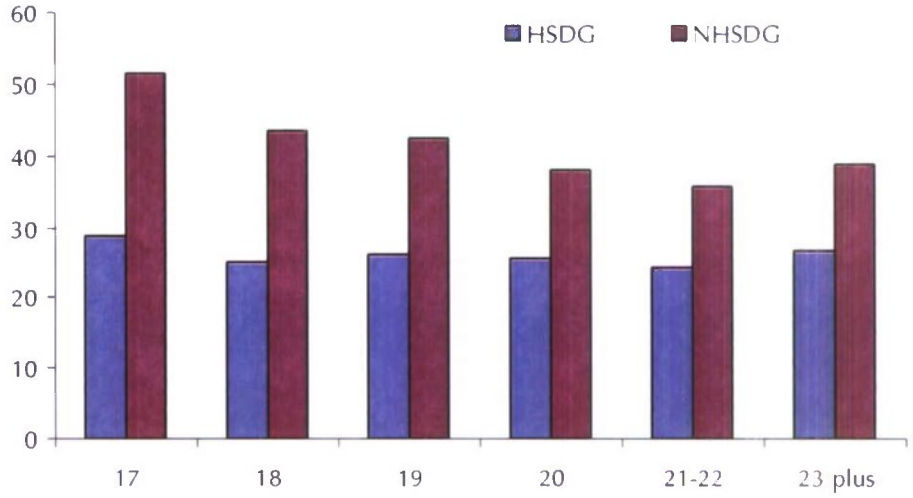
Table 5. 36-month attrition rates by age and graduation status[a]

Age (years)	HSDGs	NHSDGs
Less than 18	25.7*	47.8**
18	23.7	40.7
19	26.1**	42.4
20	26.4**	41.2
21-22	26.3**	37.8*
23 or more	30.1**	40.9

a. One asterisk indicates significant difference from attrition rate of 18-year-old enlistees at 5-percent level or better. Two asterisks indicate significant difference from attrition rate of 18-year-old enlistees at 1-percent level or better.

In our regression results, we use a series of dummy variables to test the effect of age on attrition because table 5 suggests that the age effects are nonlinear (at least for NHSDGs). The regression results are similar to the descriptive statistics in table 5. For HSDGs, those who are 17 years of age have higher 36-month attrition than 18-year-olds; the regression-adjusted difference is 4 percentage points (see figure 3). Although those who enlisted at age 23 or greater have somewhat higher attrition rates, there is no appreciable difference in attrition rates between those who are 19 to 22 and those who are 18. For NHSDGs, however, the pattern is different. Those who enlist early (at age 17) again have higher attrition rates than 18-year-old enlistees, and the difference is large—about 8 percentage points. However, older recruits (all of those age 20 or more) have substantially lower attrition rates than 18-year-old NHSDGs. Therefore, a 17-year-old NHSDG has a predicted attrition rate that is roughly 15 percentage points higher than that of a 21-year-old NHSDG.

Figure 3. Regression-adjusted attrition rates by age and education credential[a]



a. In the case of HSDGs, only the coefficient on "age 17" is significant at the 5-percent level. In the case of NHSDGs, the coefficients on "age 17," "age 20," "age 21-22," and "age 23 plus" are significant at the 1-percent level or better. Complete regression results are listed in tables 20 and 21.

Time in DEP

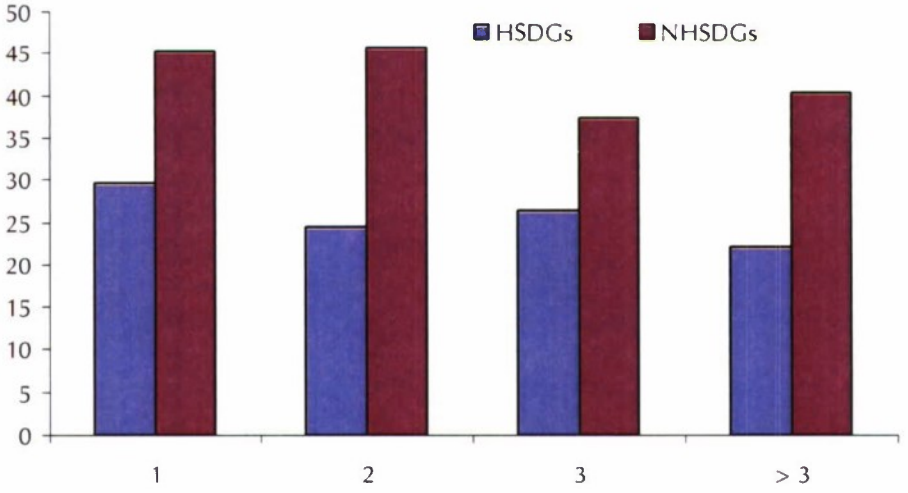
Recruits often spend several months in the Delayed Entry Program (DEP) before attending bootcamp. Previous research indicates that those spending more than 1 month in DEP have lower attrition than other recruits (see, for example, [37]). Our data indicate the same, as shown in table 6. However, our data also suggest that the difference in attrition rates is smaller for HSDGs than for NHSDGs.

Table 6. Attrition rates, by time spent in DEP and education credential

Months in DEP	HSDGs	NHSDGs
1	31.0	45.8
2	23.7	41.2
3	23.4	33.5
More than 3	20.7	36.7
Months in DEP missing	25.4	40.3

We note that our data do not include months in DEP for the vast majority of enlistees who entered the Services during FY 1999. In our regression results, we use a series of dummy variables to test the effect of months in DEP on attrition while holding other factors constant. (To deal with the missing data problem, we also include a variable indicating that we have no information on how long the recruit spent in DEP.) Our results indicate that the differences by time spent in DEP are indeed larger for NHSDGs than for HSDGs. In the case of HSDGs, those who spent no more than 1 month in DEP have higher attrition than those who spent 3 months; the difference is about 3 percentage points. Those who spent more than 3 months in DEP also have lower attrition rates (some recruits spend as much as 1 year in DEP). In the case of NHSDGs, those who spent less than 3 months in DEP have attrition rates that are about 8 percentage points higher than those who spent 3 months (see figure 4).[13]

Figure 4. Regression-adjusted attrition rates, by months in DEP and education credential[a]



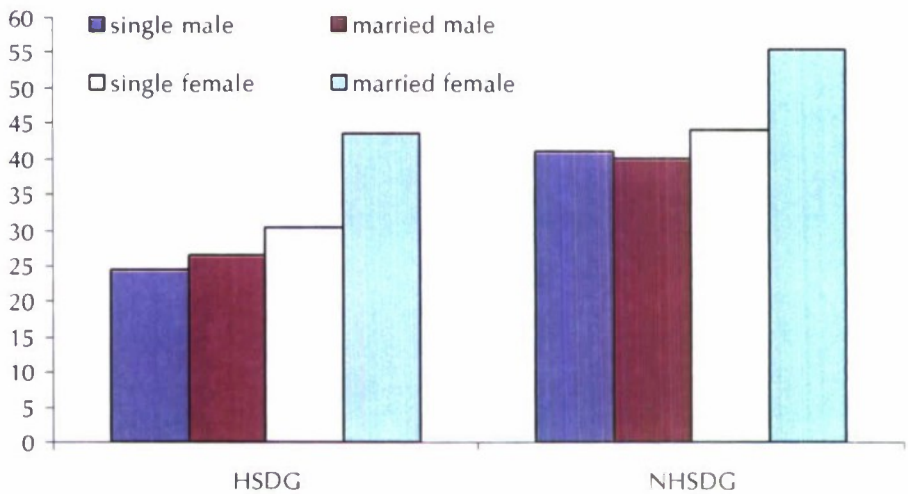
a. Complete regression results listed in tables 20-21.

13. In both regressions, the coefficient on "months in DEP missing" was insignificant at the 5-percent level, indicating no substantial differences in attrition between those whose files contain the information and those whose files do not.

Marital status

The vast majority of recruits (93 percent) are unmarried when they enter the Armed Services. While this is true for men and women, women are somewhat more likely than men to be married at time of entry; over 9 percent of women are married when they enter the Armed Services. Army recruits are most likely to be married; Marines are least likely to be married. Married recruits may face different pressures than single recruits, so we test the hypothesis that attrition varies by marital status. Also, married men and married women may face different pressures, so we examine each group separately. As shown in figure 5, married enlistees have higher attrition rates than unmarried enlistees; married women have by far the highest attrition rate of the four groups.

Figure 5. Attrition rates of men and women, by marital status and education credential



When we control for other factors using regression analysis, the difference between the attrition rates of single men and married men is actually caused by those other factors; after holding these factors constant, the difference between single and married men is small and

insignificant (see table 7). The difference between single and married women, however, remains significant and substantial.[14]

Table 7. Predicted 36-month attrition rates, by marital status, compared with those of single men[a]

	HSDGs	NHSDGs
Single men, probability of attrition	26.3	41.0
Married men	+ 0.13 percentage pts.	- 2.4 percentage pts.
Single women	+ 8.0 percentage pts.*	+ 6.1 percentage pts.*
Married women	+ 17 percentage pts.*	+ 15 percentage pts.*

a. Asterisk indicates that coefficient is significant at the 1-percent level or better.

Our results show that married women have higher attrition than single women. This result could be driven by women's increased household responsibilities, especially in the cases where children are present. However, when we added a measure indicating that the recruit was a parent, the result was small and insignificant. Also, when we added a variable indicating that the recruit was a *mother*, the result again was small and insignificant. Therefore, it seems that the effect of marriage on women is not due to child-rearing responsibilities.

14. The regression-adjusted differences between single and married women (shown in table 7) are smaller than the differences shown in figure 5. This means that married women have other characteristics that increase their attrition rates compared with single women, and some of the difference in figure 5 is due to these other characteristics. The most relevant characteristic is education credential; married women are more than twice as likely as single women to be NHSDGs. Thus, some of the difference in figure 5 is due to marital status and some is due to education credential. Separating these effects requires reporting regression-adjusted figures, as we do in table 7. We also note that when testing various specifications, we also discovered that the attrition rates of single men and single women are practically identical for dropouts and those holding GEDs.

Possibly, married women enlistees are especially likely to be married to other Armed Services personnel; this could increase attrition because of problems coordinating their careers. Another possibility is that married women who enlist may be the secondary earners in their households and may tend to leave the Services because of their spouses' jobs. Finally, married women may lack some form of support within the Services that is necessary for their success. In any case, it is interesting that, if one estimates regression results without a variable indicating marital status, women's predicted attrition rates are about 8 percentage points higher than those of men. Thus, especially in the case of NHSDGs, some of the effect that appears to be connected to gender is actually connected to marital status. More study could reveal what drives this result.[15]

"Determination"

Our questionnaire asked enlistees whether they had ever considered dropping out of high school; both HSDGs and NHSDGs answered the question. Among HSDGs, 14 percent indicated that they considered dropping out of high school.[16] Those who considered leaving school were asked to give all relevant reasons from the following list:

- I was bored, wasn't learning anything useful.
- The rules were too strict.
- I wasn't going to graduate on time.
- I didn't get along with the teachers, counselors, or principal.
- I didn't get along with other students.
- I was getting bad grades.

15. Reference [8] notes that women who leave school due to pregnancy and later earn GEDs have somewhat higher earnings than other GED holders. We would like to test this effect here, but the small number of enlistees who are unmarried mothers with GEDs prevents us from doing so.

16. Nearly 7 percent of the sample, and nearly 7 percent of those who left high school, skipped this question. Rather than assuming an answer for those who skipped the question, we do not include them in this section of the analysis.

- My family needed money/needed me at home.
- I got married or became a parent.
- I wanted to work full time.
- I was expelled/suspended.
- Other.

Reasons for dropping out seem complicated; while 46 percent gave only one reason, 28 percent stated three or more reasons. Also, the results suggest the list on the survey may not have been exhaustive; the most common reason given is "Other" (in these cases, most also provide at least one other reason). Of those who considered leaving high school, 45 percent cited "Other," while 38 percent cited the second most common reason, "I was bored, wasn't learning anything useful."

We classify the first five reasons as "lack of determination" as suggested by [8]. We refer to enlistees who did *not* select any of these reasons as "determined." As shown in table 8, determined enlistees have much lower attrition rates than others (see columns 1 and 2). However, determined enlistees are much more likely than others to be HSDGs, so we also examine attrition rates of HSDGs only. Although all HSDGs did go on to complete school, determined enlistees again have markedly lower attrition rates (columns 3 and 4).

Table 8. Attrition rates by level of "determination"[a]

Attrition rate	(1) Entire sample, "determined"	(2) Entire sample, not "determined"	(3) HSDGs, "determined"	(4) HSDGs, not "determined"
6-month	10.7	20.5	9.9	17.1
12-month	15.0	27.4	13.9	23.6
24-month	21.3	36.6	19.8	31.0
36-month	26.3	43.3	24.6	36.7

a. In each case, the difference between "determined" enlistees and others is statistically significant at the 0.1-percent level or better.

Determination varies with other characteristics, too. White recruits are more likely than recruits of other ethnicities to state that they considered dropping out of school; male recruits are more likely than female recruits to state the same. As we would expect, those who did not complete high school have relatively low measures of determination. Private school graduates have slightly lower levels of determination than public school graduates (see table 9).[17]

Table 9. Percentage classified as "determined," by education credential

Education credential	Percent "determined"
Public school graduate	91.4
Private school graduate	90.3
Certificate holder	87.8
ChalleNGe graduate	46.2
GED holder	47.1
1 semester college, vocational	63.5
1 semester college, academic	69.6
Dropout, no credential	58.3

Finally, we examine how these stated reasons affect recruit performance. Holding other characteristics constant, regression results indicate that determination is associated with decreased attrition for both HSDGs and NHSDGs. The percentage differences in attrition for nonpersisters are as follows (for each, coefficient is significant at 1 percent or better):

17. Private school graduates are also more likely than public school graduates to have considered dropping out of school for *any* reason. Twenty-five percent of male recruits, and 17 percent of female recruits, stated that they considered dropping out of school. Seventeen percent of private school graduates, and 14 percent of public school graduates, stated that they considered dropping out. These differences are statistically significant at better than the 1-percent level; gender: $t = 16.5490$, $p > t = 0.0000$; public-private school graduates: $t = 3.9016$, $p > t = 0.0001$.

- HSDGs: Determined enlistees have predicted attrition rates roughly 6 percentage points lower than other HSDGs (25.2-percent probability of attrition versus 30.6-percent probability).
- NHSDGs: Determined enlistees have attrition rates 4 percentage points lower than other NHSDGs (40.5-percent probability of attrition versus 44.7-percent probability of attrition).

Waivers, GEDs, and AFQT scores

The findings of [8] and [26] suggest that GED holders, as well as dropouts with high AFQT scores, are likely to engage in illicit activities. People with criminal records may be refused entry into the Services or may be accepted with a waiver. When we examine the relationship between waiver status and GED status, we find that among NHSDGs those holding GEDs are more likely than others to have a waiver (see table 10). When we look at various types of waivers, we find that those holding GEDs are more likely than other NHSDGs to have a legal waiver; specifically, they are more likely to have a "serious" legal waiver (defined as a waiver for a serious misdemeanor or a felony).[18] Regression results indicate that those holding GEDs are significantly more likely to have a waiver than other NHSDGs, even after correcting for other characteristics.

Table 10. Waiver status of NHSDGs[a]

	Those holding GEDs	Other non-graduates
Percentage with any waiver	44.8	38.1
Percentage with legal waiver	14.8	11.1
Percentage with "serious" legal waiver	13.1	8.8

a. Differences between GED holders and other NHSDGs are all significantly different at the 1-percent level or better.

Our findings also suggest that the effects of waivers on success differ by Service. As noted in [7], the four Services assign waivers using

18. These differences are statistically significant at the 5-percent level or better.

different systems. For this reason, when we estimate the probability of attrition for HSDGs and NHSDGs, we estimate the effects of waivers separately for each Service. Our results indicate that, for NHSDGs, waiver status explains attrition only for recruits in the Navy. HSDGs with waivers have higher attrition rates in the Marines and the Navy (see table 11).

Table 11. Predicted attrition rates by Service, waiver status, and educational credential[a]

	HSDGs		NHSDGs	
	No waiver	Waiver	No waiver	Waiver
Army	29.2	+0.4 percentage points	45.0	+1.1 percentage points
Air Force	18.3	+1.2 percentage points	24.2	- 0.2 percentage points
Marine Corps	22.1	+4.4 percentage points*	33.0	- 1.0 percentage points
Navy	27.1	+5.5 percentage points*	42.9	+6.1 percentage points*

a. An asterisk indicates that coefficient on "waiver" is significant at the 5-percent level or better.

Background characteristics

The Survey of Recruits' Education and Background contains detailed information on the attitudes, behaviors, and education credentials of recruits but little information on recruits' backgrounds. Substantial research indicates that socioeconomic status has large important effects on schooling and labor market outcomes; socioeconomic status is probably an important indicator of military success as well. Some may argue that socioeconomic status is not a policy variable.

It is unlikely that the Armed Services will accept potential enlistees based solely on their backgrounds. However, it may be important for planners to predict how potential recruits are likely to change in response to societal changes. For this reason, we recommend that key socioeconomic indicators be included on any future surveys.[19]

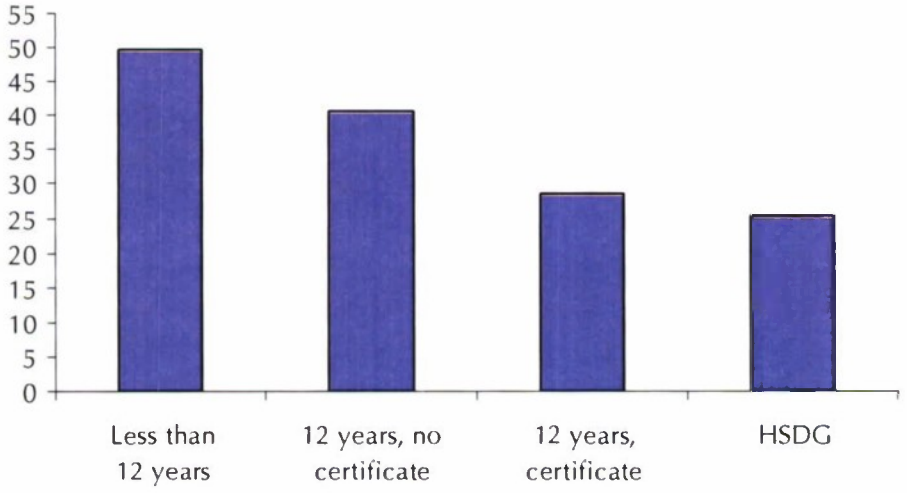
19. We included state-level background variables (such as the percentages living in poverty or having some college education) in some of our regression equations to proxy for background characteristics. However, these variables had weak explanatory power; the coefficients were small and insignificant. Measures of individual background characteristics should increase the power and precision of these estimates.

Educational characteristics

Years of education, certificates of attendance or completion

All HSDGs have completed 12 years of education (those who enlist before age 18 completed their schooling early, either by skipping a grade or starting early). However, the years of education vary among NHSDGs. Roughly 41 percent of this group began their twelfth year of schooling before leaving school; the others left at earlier points.[20] One of the noncognitive factors considered important in labor market outcomes is "persistence"; some researchers mention the importance of "seat time" (total years in school) for military enlistees. For this reason, we test the hypothesis that NHSDGs who attend more school may have lower attrition rates than others who leave school earlier. Indeed, figure 6 shows that NHSDGs who attended school for 12 years have lower attrition than other NHSDG recruits. We split NHSDGs who attended for 12 years into two groups—those with and without a certificate of attendance or completion. Having a certificate of attendance or completion is also associated with lower attrition.

Figure 6. 36-month attrition rates, by years of schooling and education credential



20. Almost all who earned a certificate of attendance or completion attended school for 12 years; of the other NHSDGs, nearly two-thirds left before beginning their twelfth year of school.

One relatively recent change in education is that many states now award high school degrees only to those students who complete all course requirements *and* pass a final, standardized exam. As a result of this reform, there are students who satisfactorily completed all of their coursework but do not receive a diploma. If, in fact, "seat time" is important, these students should actually perform quite well in the military (especially holding AFQT scores constant). As table 12 shows, relatively few of these enlistees ever considered dropping out of school, and the majority can be classified as "determined". However, this group tends to have quite low AFQT scores, which is probably related to their problems passing standardized tests. In terms of attrition, however, table 12 indicates that certificate holders compare very favorably with dropouts and other NHSDGs throughout their first 3 years of service. Their attrition rates, in fact, are only slightly higher than those of traditional diploma graduates.[21]

Table 12. Enlistees holding a certificate of attendance or completion compared with dropouts and HSDGs

	Certificate of attendance/ completion	Traditional (public) high school graduate	Dropout
Percentage who considered dropping out	23.3	13.8	100
Determination	87.8	91.4	58.4
Average AFQT score	51.5	59.0	56.9
6-month attrition	12.5	10.4	20.5
12-month attrition	17.4	14.6	28.4
24-month attrition	22.6	20.6	38.5
36-month attrition	27.0	25.4	46.0

Our regression-adjusted results reveal that after controlling for AFQT scores and other personal characteristics, attending school into the

21. In the regression including all enlistees, the attrition rate of certificate holders is insignificantly different from that of traditional high school diploma graduates (see table 19 in appendix). Current certificate holders have lower attrition rates than this group recorded historically. For example, [11] calculates 24-month attrition rates for FY 1988–1993 accessions; for that sample, certificate holders had attrition rates lower than those of GED holders or dropouts, but substantially higher than those of high school diploma graduates.

twelfth grade is associated with much lower attrition rates (see table 13). Simply attending school into the twelfth grade lowers predicted attrition by 9 percentage points; having a certificate of attendance or completion lowers predicted attrition rates by an additional 12 percentage points. This suggests that, among NHSDGs, those with more schooling perform much better in the military.

Table 13. Regression-adjusted attrition rates of NHSDGs, by years of schooling[a]

Years, credential	Predicted 36-month attrition rate
Less than 12 years, no credential	45.5
12 years, no credentials	36.4
12 years, certificate of completion/ attendance	34.5
HSDG	25.6

a. All coefficients are different from zero at the 0.1-percentage-point level or better.

Regression results on the whole sample indicate that the adjusted attrition rates of certificate holders are slightly *lower* than similar traditional diploma graduates. (See the appendix, table 19.) Certificate holders make up the only group exhibiting significantly lower attrition than traditional high school graduates. This suggests that, as the number of certificate holders increases, this group may be an excellent source of recruits.[22]

22. We provide one caveat to these findings: these certificate holders are very likely to be misclassified as HSDGs according to their official DMDC records; those whose DMDC records indicate they hold a certificate often indicate on the survey that they hold a GED. Our earlier report [5] indicated that misclassification occurs often with NHSDGs, but the level of misclassification for this group is unusually high. It is possible but unlikely that the recruits misunderstood the survey; it is much more likely that recruiters do not recognize that the certificates held by this group differ from traditional high school diplomas. Even when we use the recruits' official (DMDC) education records, those with certificates have attrition rates far below those of GEDs and dropouts; however, according to official records, the certificate holders have attrition rates that are somewhat higher than those of traditional diploma graduates.

Expulsion

We expect that recruits who have been expelled from school will have higher attrition rates than other similar recruits. Expulsion, which usually occurs for behavioral (rather than academic) reasons is likely to be a predictor of poor performance in the military. NHSDGs are far more likely than HSDGs to report expulsion; 12 percent of all NHSDGs and 3 percent of all HSDGs report being expelled at some point (see table 14).

Table 14. Rates of expulsion by education credential

Credential	Percentage ever expelled
All HSDGs:	**3.2**
Public high school diploma	3.1
Private school diploma	4.8
All NHSDGs:	**11.5**
GED	13.5
Dropout	13.6
ChalleNGe	19.1
1 semester college, academic	8.7
1 semester college, vocational	11.6
Certificate of completion	5.8
Occupational certificate	6.4
Correspondence school certificate	8.3
Adult education certificate	13.1

Our regression results indicate that, even while holding constant other factors, those who have been expelled are much more likely to attrite. For HSDGs, the difference is 6.2 percentage points, and, for NHSDGs, those who have been expelled are 5.3 percentage points more likely to attrite than other similar recruits.[23]

23. The coefficient is different from zero at the 1-percent level or better in both cases.

Public versus private schools

One advantage of our data set is that it includes information on the type of school each recruit attended in each year of schooling. We collected this information to test various definitions of a homeschooled recruit and to find out how extensive homeschooled recruits' homeschooling experiences were, but it is also useful for other reasons. For example, we know not only which recruits graduated from private schools but which recruits *ever* attended private schools. Roughly 4 percent of enlisted recruits graduated from private high schools.[24] However, a total of 18 percent attended private schools at some point during their school careers. Among those who ever attended private schools, the average enlistee spent 4 years in private schools. Enlistees are more likely to have attended private schools in the early grades than in high school.

Thirteen percent of enlistees who graduated from public schools ever attended private schools. Contrary to what we might expect, enlistees holding GEDs or no credential are *more* likely to have attended private schools at some point during their school career than enlistees who graduated from public schools (see table 15). ChalleNGe recruits also attended private schools at relatively high rates; as shown in table 15, nearly a quarter of these recruits were enrolled in private schools at some point.

It appears that attending private school is relatively common among NHSDGs. NHSDGs are also more likely to have been expelled from school than HSDGs (refer to table 14). It is possible that some were expelled from public schools, next enrolled in private schools, and eventually dropped out. As a group, private school students complete high school and attend college at high rates [30], but our results suggest that private school students who enlist in the military are *not* typical of all private school students.

24. About 10 percent of all traditional high school diploma holders graduate from private school [9].

Table 15. Percentage of enlistees who ever attended private schools, by eventual credential

Credential	Percentage *ever* enrolled in private schools
HSDGs:	
Public high school diploma	12.8
Private school diploma	100.0
NHSDGs:	
GED	17.6
Dropout	16.1
ChalleNGe	23.4
1 semester college, academic	24.9
1 semester college, vocational	19.4
Certificate of completion	16.4
Occupational certificate	16.8
Correspondence school certificate	17.9
Adult education certificate	17.0

Table 16 shows attrition rates for public and private school diploma graduates, as well as for those who ever attended private schools. Private school graduates have attrition rates slightly higher than those of public school graduates; attrition rates of those who attended (but did not graduate from) private schools are higher still. Regression results reveal that, when holding other traits constant, the attrition rates of private school graduates are practically identical to those of public school graduates (see tables 19 and 20 in the appendix). When we add a variable indicating the recruit *ever* attended a private school, regression results indicate, across the sample, that private school attendees have slightly higher attrition rates than other enlistees.[25]

In summary, there is no reason to believe that private school diploma graduates perform better than public school graduates in the military; in fact, those private school graduates who enlist seem to leave the military at slightly higher rates. This, along with the relatively high

25. Regression results indicate that those who ever attended private schools have 36-month attrition rates about 1 percentage point higher than similar recruits. The effect, however, is only marginally significant; there is a 6-percent chance that the effect occurred randomly.

percentage of NHSDGs who attended private schools at some point, suggests that private school enlistees are not typical of all private school graduates. Instead, private school graduates who enlist may be those who transfer into private schools after encountering problems in public schools. (Survey responses indicate that many NHSDGs who attended private schools did so in the later grades; in contrast, public school diploma graduates who attended private schools were much more likely to attend private schools in the elementary grades.)

Table 16. Attrition rates for public and private school attendees

	Diploma graduates		Private school experience	
Attrition	Public school	Private school	Those who *ever* attended	*Ever* attended but did not graduate from
6-month	10.4	11.5	12.3	12.6
12-month	14.6	15.9	17.4	17.9
24-month	20.6	22.5	24.3	24.8
36-month	25.4	27.1	29.6	30.3

Homeschooling and state regulations

In this section, we explore how the substantial variation in state-level regulation affects homeschoolers' outcomes in the military. Initially, we separate homeschooled recruits based on the level of regulation in their home state and examine attrition rates. Table 17 shows that homeschooled recruits from states with minimal regulations (states not even requiring that parents notify school officials of the decision to homeschool) have much higher attrition rates than homeschooled recruits from states with more requirements.

Table 17 does not correct for many other factors that affect attrition. For example, the age or test scores of homeschooled recruits could differ in the minimally regulated states for reasons that have little or nothing to do with homeschooling. We use regression analysis to look at the effect of homeschooling regulations while holding other factors constant. Our regression results confirm the results in table 17; although all homeschooled recruits have higher attrition rates than traditional public school graduates (as detailed in [7]), we find that

state-level regulation has an additional effect on attrition. Overall, homeschooled recruits from minimally regulating states have 36-month attrition rates that are 17 percentage points *higher* than similar homeschooled recruits from states with more stringent regulation (see the appendix, table 22). Therefore, our results indicate that, among homeschooled recruits, those from states with more stringent regulations are more likely to be successful in the military.

Table 17. Attrition rates of homeschooled recruits by level of state regulation[a]

Attrition	Recruits from states not requiring notification	Recruits from states requiring notification
6-month	19.9*	13.0
12-month	31.2**	19.5
24-month	44.7**	28.6
36-month	51.8**	34.3

a. One asterisk indicates that attrition rate is different from that of recruits in states requiring notification at 5-percent level or better. Two asterisks indicate that attrition rate is different from that of recruits in states requiring notification at 1-percent level or better. Refer to table 3 for breakdown of states by level of regulation.

It is worth noting that homeschooling associations actively work to lower the level of regulation. The most active organization is probably the Home School Legal Defense Association (HSLDA). As an example, its website has urged homeschooling parents to work to achieve passage of the "Homeschool Freedom Bill," HB 675. If passed, this bill will decrease the level of regulation that Virginia homeschooling families face; after passage, families will no longer be required to seek district approval to homeschool, and homeschooling parents with no high school diploma will be permitted to homeschool.[26] For this reason, it is likely that legislation will lower requirements on homeschooling families in the future. This analysis suggests that, after such legislation, homeschooled recruits would have higher overall attrition rates in the military than they do today.

26. http://hslda.org/hs/state/va/200402251.asp, accessed 13 April 2004.

ChalleNGe participants

Our survey identified 239 recruits who enlisted as ChalleNGe program graduates; this was one of the populations that entered under the 5-year pilot program. However, the survey also allows us to identify people who participated in the ChalleNGe program and either did not complete the program or did not pass the GED. According to the survey, 97 respondents who entered the military as dropouts indicate that they took part in but did not complete the ChalleNGe program or that they completed the ChalleNGe program but did not earn a GED. (Others indicate that they took part in ChalleNGe but also earned a traditional high school diploma or earned another alternate credential.)

Roughly one-third of all ChalleNGe graduates enlisted in the Army; another third enlisted in the Navy. However, the vast majority (86 percent) of those who participated in but did not complete the ChalleNGe program enlisted in the Army. Reference [7] points out that ChalleNGe recruits have high attrition rates compared with traditional graduates, especially at the 24- and 36-month marks. However, the attrition rates of ChalleNGe graduates compare favorably with those of some other NHSDGs.

Here, we examine the attrition rates of ChalleNGe participants who did not complete the program; attrition rates of this group are higher than those of other NHSDGs and are on a par with those of dropouts (see table 18). Those who fail to complete ChalleNGe do not perform well in the military.

Table 18. Attrition rates of ChalleNGE participants who did not complete the program

Attrition rate	ChalleNGe non-completers	Dropouts
6-month	19.9	20.5
12-month	28.0	28.4
24-month	38.7	38.5
36-month	47.5	46.0

To examine this group more closely, we look only at ChalleNGe graduates, ChalleNGe participants who neither completed ChalleNGe nor earned another credential, and dropouts. We argue that it is appropriate to compare ChalleNGe non-completers with other dropouts because both groups have no recognized credential. Regression results indicate that predicted attrition rates of those who participate in but do not complete the ChalleNGe program are *higher* than the rates of similar high school dropouts, while the attrition rates of those who complete the program are lower than those of other dropouts. This suggests that the ChalleNGe program has a positive impact on those who *complete* it; to state our results another way, ChalleNGe completers have attrition rates that are significantly lower than those of ChalleNGe non-completers. Our results indicate that 46 percent of dropouts are predicted to attrite during the first 36 months of service. In contrast, 41 percent of ChalleNGe graduates are predicted to attrite while 59 percent of those who do not complete ChalleNGe (or another credential) are predicted to attrite. Therefore, ChalleNGe completers have regression-adjusted predicted attrition rates that are 18 percentage points below those of ChalleNGe non-completers.

Conclusions and recommendations

As in the past, education credentials remain strong predictors of attrition. However, our independent survey provides additional information not usually included in official records and not directly related to education credential, such as measures of attitudes and past behaviors. In some cases, these measures have a substantial influence on the likelihood of attrition. For example, recruits who report frequent use of tobacco before entering the Delayed Entry Program (DEP) have higher attrition rates than nonsmoking recruits. This effect is quite large; frequent smoking is predicted to increase attrition about as much as dropping out of school and attaining a GED. In other cases, we find that characteristics included in previous research have different effects on HSDGs versus NHSDGs, or on women versus men. For example, married women attrite at much higher rates than single women, whereas marital status has little effect on male recruits' attrition rates.

We do not understand exactly how these characteristics affect attrition. For smokers, the attrition difference persists beyond bootcamp, so we do not believe it is related to differences in physical fitness. In the case of married women, childcare responsibilities do not seem to be driving this effect; we suspect it may involve spouses' career demands or some aspect of military life that causes particular difficulties for married women. Although we attempted to focus on policy-relevant variables in this research, we recognize that such factors as smoking behavior and marital status may be difficult to measure with accuracy or impractical to consider when selecting recruits. However, we believe that future research should attempt to more closely define the relationship between these characteristics and attrition.

Among personal characteristics, age is also an important determinant of attrition, but the effects differ for HSDGs and NHSDGs. All recruits who enlist before turning 18 have higher attrition rates, but NHSDGs who enlist at age 20 or more have lower attrition than their younger

counterparts. This may be due to older NHSDGs' work experience; the time between leaving high school and joining the military may have afforded this group the chance to learn how to complete tasks or accomplish goals. Younger NHSDGs, in contrast, often enter the military fresh from high school; after having recently left school, they may be especially likely to leave the military as well.

Beyond these personal characteristics, we find persuasive evidence that certain noncognitive factors are important in explaining attrition. For example, recruits who indicate that they considered leaving school because of boredom, problems following the rules or getting along with authority figures, or anticipated delays in graduation have much higher attrition rates than similar recruits, even if the recruits who considered leaving school actually stayed to graduate.

Enlistees who did not complete all graduation requirements but persisted in school and attained a certificate of completion or attendance have attrition rates much lower than other NHSDGs. In fact, these "certificate holders" have attrition rates on a par with those of traditional diploma graduates (holding constant other personal characteristics). At the same time, other school characteristics not usually included in attrition regressions are also important. For example, recruits who were ever expelled from school have substantially higher attrition rates than others. Among NHSDGs, those who remained in school at least until the beginning of the twelfth grade have significantly lower attrition rates than others. As mentioned, those who did not consider leaving school have lower attrition rates than those who did consider it. All of these characteristics can be characterized as measures of "persistence"; a consistent finding in this research is that people with more persistence do better in the military. This is true when persistence is measured by completion of requirements, staying in school longer, avoiding expulsion, or not considering dropping out. For recruiting purposes, it may be possible to measure this persistence through a survey, or further research may find that persistence is associated with more easily measured traits, such as enrolling in or completing difficult coursework.

These findings suggest concrete ways to lower attrition. Due to current education reforms, both the number of GED holders *and* the

number of certificate holders are likely to increase in the future. This research suggests that the Services could lower overall attrition rates by recruiting fewer GED holders and more certificate holders. (In recent years, the number of GED holders in the military has increased along with the number of GED holders in the population). In addition, giving preference to those who have not been expelled is likely to lower attrition, as is selecting NHSDGs with as many years of schooling as possible.

We also look at the attrition rates of private school graduates, which are very similar to those of graduates of public schools. Private school graduates, however, are more likely to have been expelled from a school than are public school graduates. Also, many NHSDGs in our sample attended private schools at some point. This information suggests that the private school graduates who enlist are not typical of all private school graduates.

Education credentials and personal characteristics come bundled together in recruits; people with certain education characteristics are also more likely to have certain personal characteristics. For example, GED holders are relatively likely to have waivers, to have been expelled from schools, to lack "determination" as we measure it, and to have used tobacco before entering DEP. GED holders have higher attrition rates than high school diploma graduates, and each of these personal characteristics is also associated with increased attrition. Therefore, some of the difference in attrition rates between GED holders and diploma graduates is associated with the credential and some is associated with the personal characteristics. For this reason, including such noncognitive factors in regression equations separates the effect of credentials from that of the personal characteristics and suggests, again, that overall attrition could be decreased by selecting those NHSDGs with the most favorable personal characteristics.

One other important group of personal characteristics not included in official records or in this data set is family background, defined by such things as parental education and occupation. These characteristics provide a large amount of explanatory power in equations explaining educational attainment. We recommend that such characteristics be collected as part of future research efforts; this would help

military planners to anticipate how changes in society at large are likely to affect attrition rates.

We also find that state-level regulations can affect recruit quality. The rates at which students earn GEDs and certificates of completion are related to state policies. Also, we find that homeschooled recruits from states with minimal levels of regulation have higher attrition rates than similar recruits from states with more stringent regulations. We expect the level of regulation on homeschoolers to decrease in the future; like the increases in GED holders and certificate holders, this change could affect recruit quality.

In revisiting the ChalleNGe program, we find that enlistees who failed to complete the program and did not earn another credential have attrition rates higher than those of ChalleNGe graduates, and higher than those of other dropouts. This suggests that ChalleNGe has a positive effect on those who complete the program.

Finally, we note that there are limits to explaining attrition using only data on individuals. In the same manner that peer effects often prove important in research on civilian education, characteristics of other enlistees, officers, and working conditions may explain substantial amounts of attrition behavior. Like most other researchers, we do not include such measures in our equations, but our results are consistent with the importance of these factors. For example, "social support" or similar factors may have large effects on attrition rates, especially in the case of enlistees in their first term of service.

In summary, our results suggest that, although education credential remains a strong, consistent predictor of attrition, other factors are also extremely important. This provides the Services with the opportunity to lower overall attrition rates by screening for recruits with strong noncognitive factors.

Appendix: Regression results

This appendix includes complete regression results explaining 36-month attrition. Table 19 includes results for the entire sample. Table 20 includes graduates only; table 21 includes nongraduates only. Table 22 includes regression results for homeschooled recruits (compared to HSDGs). The results are unweighted. We run logit regressions.

Because the interpretation of the estimated coefficients is not straightforward, we calculate and include marginal effects in the tables. The marginal effects indicate the change in the predicted probability (in percentage points) of attrition associated with a one-unit change in the independent variable. For example, the marginal effects associated with the variable "AFQT" indicate how much predicted attrition differs with each one-point increase in AFQT scores. The marginal effect for each education category (i.e., "private school graduate") indicates the percentage-point difference in predicted attrition between private school graduates and the omitted category. In all regressions, "male" (married or single), "white, non-Hispanic," "nonsmoker," "three months in DEP", and "age 18" are the omitted categories. In tables 19, 20, and 22, "public school graduate" is the omitted education category; in table 21, "dropout" is the omitted education category. We also control for the unemployment rate in the recruit's home state, branch, and occupational category. Finally, each regression equation includes a constant.

Table 19. Regression results, entire sample[a]

Variable	Mean	Coefficient	z-ratio	Marginal effect
Age 17	0.055	0.2214	4.52	4.6
Age 19	0.241	0.0442	1.54	0.9
Age 20	0.114	-0.0212	-0.57	-0.4
Age 21-22	0.115	-0.0950	-2.48	-1.9
Age 23 or more	0.090	0.0301	0.71	0.6
Married female	0.016	0.7607	9.32	17.3
Single female	0.161	0.3834	12.32	8.1
African-American	0.197	0.1271	3.91	2.6
Hispanic	0.106	-0.2485	-5.22	-4.8
Asian-Pacific Islander	0.049	-0.2774	-4.90	-5.2
Other race	0.065	0.0053	0.09	0.1
AFQT	58.7	-0.0077	-11.40	-0.2
DEP months missing	0.688	0.0007	0.01	0.01
One month in DEP	0.141	0.2061	3.06	4.3
Two months in DEP	0.042	0.0087	0.11	0.2
> 3 months in DEP	0.098	-0.1448	-2.04	-2.8
Ever expelled	0.047	0.2848	5.82	6.0
Determined	0.137	-0.2888	8.94	6.1
Light smoker	0.180	0.2142	6.87	4.4
Heavy smoker	0.317	0.6456	24.95	13.5
Army waiver	0.040	0.0245	0.43	0.5
Air Force waiver	0.033	0.0647	0.93	1.3
USMC waiver	0.099	0.1827	2.99	3.8
Navy waiver	0.105	0.2693	6.44	5.6
Private school graduate	0.043	0.0497	0.88	1.0
GED	0.049	0.5095	10.50	11.1
1 sem college, academic	0.024	0.2110	3.02	4.4
1 sem college, vocation	0.007	0.4386	3.65	9.6
Adult education	0.024	0.3394	5.15	7.3
Correspondence school	0.003	-0.1139	-0.57	-2.2
Occupational certificate	0.012	0.0118	0.12	0.2
Cert of complete/attend	0.016	-0.1746	-1.85	-3.4
Dropout	0.041	0.4720	9.10	10.3

a. Logit regression. Dependent variable is "attrited before fulfilling 36 months of obligation."

* Indicates coefficient is significant at 5-percent level or better.

** Indicates coefficient is significant at 1-percent level or better.

"Public school graduate" is omitted education category.

Regression also includes unemployment rate, branch, and occupational category as well as a constant.

Adjusted R-squared: 0.2271. Number of observations: 56,576.

Table 20. Regression results, HSDGs[a]

Variable	Mean	Coefficient	z-ratio	Marginal effect
Age 17	0.057	0.1859	3.40	3.6
Age 19	0.243	0.0512	1.60	1.0
Age 20	0.109	0.0198	0.47	0.4
Age 21-22	0.105	-0.0471	-1.06	-0.9
Age 23 or more	0.076	0.0826	1.64	1.6
Married female	0.014	0.8033	8.48	17.4
Single female	0.174	0.4083	12.20	8.0
African-American	0.200	0.1056	2.90	2.0
Hispanic	0.104	-0.2662	-4.89	-4.6
Asian-Pacific Islander	0.048	-0.2823	-4.34	-4.9
Other race	0.064	-0.0241	-0.37	-0.4
AFQT	59.2	-0.0079	-10.60	-0.2
DEP months missing	0.719	-0.0795	-1.05	-1.5
One month in DEP	0.117	0.1620	2.06	3.1
Two months in DEP	0.040	-0.1179	-1.26	-2.1
> 3 months in DEP	0.095	-0.2443	-2.97	-4.3
Ever expelled	0.047	0.3119	4.82	6.2
Determined	0.137	-0.3269	-7.89	-6.4
Light smoker	0.180	0.1883	5.44	3.6
Heavy smoker	0.317	0.6471	22.25	12.7
Army waiver	0.040	0.0196	0.30	0.4
Air Force waiver	0.033	0.0643	0.87	1.2
USMC waiver	0.099	0.2290	3.36	4.4
Navy waiver	0.105	0.2823	5.49	5.5
Private school graduate	0.043	0.0437	0.77	0.8

a. Logit regression. Dependent variable is "attrited before fulfilling 36 months of obligation."

* Indicates coefficient is significant at 5-percent level or better.

** Indicates coefficient is significant at 1-percent level or better.

"Public school graduate" is omitted education category.

Regression also includes unemployment rate, branch, and occupational category as well as a constant.

Adjusted R-squared: 0.2120. Number of observations: 46,570.

Table 21. Regression results, NHSDGs[a]

Variable	Mean	Coefficient	z-ratio	Marginal effect
Age 17	0.049	0.3256	2.84	8.1
Age 19	0.233	-0.0308	-0.45	-0.8
Age 20	0.138	-0.2189	-2.70	-5.4
Age 21-22	0.159	-0.3063	-3.90	-7.5
Age 23 or more	0.157	-0.1836	-2.25	-4.5
Married female	0.026	0.6125	3.82	15.1
Single female	0.099	0.2447	2.83	6.1
African-American	0.186	0.2290	3.12	5.7
Hispanic	0.117	-0.1916	-1.94	-4.7
Asian-Pacific Islander	0.054	-0.2430	-2.09	-6.0
Other race	0.069	0.1142	0.97	2.9
AFQT	56.3	-0.0072	-4.35	-0.2
DEP months missing	0.549	0.2655	1.92	6.6
One month in DEP	0.251	0.3139	2.42	7.8
Two months in DEP	0.053	0.3332	2.12	8.3
> 3 months in DEP	0.108	0.1218	0.86	3.0
Ever expelled	0.115	0.2136	2.83	5.3
Determined	0.370	-0.1699	-3.21	-4.2
Light smoker	0.163	0.3128	4.26	7.8
Heavy smoker	0.481	0.6091	10.53	15.1
Army waiver	0.050	0.0457	0.39	1.1
Air Force waiver	0.018	-0.0034	-0.03	-0.2
USMC waiver	0.101	-0.0389	-0.28	-0.9
Navy waiver	0.230	0.2462	3.28	6.1
GED	0.276	0.0005	0.01	0.01
1 sem college, academic	0.136	-0.1476	-1.67	-3.7
1 sem college, vocation	0.040	0.0638	0.48	1.6
Adult education	0.136	0.0517	0.56	1.3
Correspondence school	0.018	-0.3981	-1.88	-9.7
Occupational certificate	0.066	-0.3077	-2.51	-7.6
Cert of complete/attend	0.091	-0.4896	-4.11	-11.9
Twelve years of school	0.4314	-0.3687	-5.01	-9.1

a. Logit regression. Dependent variable is "attrited before fulfilling 36 months of obligation."

* Indicates coefficient is significant at 5-percent level or better.

** Indicates coefficient is significant at 1-percent level or better.

"Dropout" is omitted education category.

Regression also includes unemployment rate, branch, and occupational category as well as a constant.

Adjusted R-squared: 0.2387. Number of observations: 10,006.

Table 22. Regression results, HSDGs and homeschooled recruits[a]

Variable	Mean	Coefficient	z-ratio	Marginal effect
Age 17	0.058	0.1909	3.55	3.7
Age 19	0.242	0.0471	1.48	0.9
Age 20	0.109	0.0192	0.46	0.4
Age 21-22	0.105	-0.0442	-1.01	-0.8
Age 23 or more	0.076	0.0747	1.49	1.4
Married female	0.014	0.8019	8.52	17.4
Single female	0.174	0.4034	12.13	8.0
African-American	0.199	0.1015	2.80	1.9
Hispanic	0.104	-0.2584	-4.78	-4.5
Asian-Pacific Islander	0.048	-0.2861	-4.42	-4.9
Other race	0.064	-0.0307	-0.48	-0.6
AFQT	59.2	-0.0081	-10.96	-0.1
DEP months missing	0.717	-0.1107	-1.49	-2.1
One month in DEP	0.118	0.1386	1.79	2.6
Two months in DEP	0.040	-0.1353	-1.48	-2.4
> 3 months in DEP	0.096	-0.2689	-3.33	-4.7
Ever expelled	0.032	0.3112	4.81	6.2
Determined	0.088	-0.3260	-7.98	-6.4
Light smoker	0.184	0.1849	5.37	3.5
Heavy smoker	0.283	0.6466	22.42	12.8
Army waiver	0.038	0.0188	0.29	0.4
Air Force waiver	0.036	0.0787	1.08	1.5
USMC waiver	0.099	0.2325	3.43	4.5
Navy waiver	0.078	0.2835	5.57	5.6
Private school graduate	0.052	0.0443	0.79	0.8
Homeschooled, state with no regs	0.0028	1.057	5.49	23.8
Homeschooled, state with regs	0.0078	0.3359	2.64	6.7

a. Logit regression. Dependent variable is "attrited before fulfilling 36 months of obligation."

* Indicates coefficient is significant at 5-percent level or better.

** Indicates coefficient is significant at 1-percent level or better.

"Public school graduate" is omitted education category.

Regression also includes unemployment rate, branch, and occupational category as well as a constant.

Adjusted R-squared: 0.2125. Number of observations: 47,071.

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